Office of National Marine Sanctuaries/National Centers for Coastal Ocean Science Long-term Agreement (ONMS/NCCOS LTA)

2004 Annual Liaison Report on Existing and Potential ONMS/NCCOS Collaborative Studies at the Gulf of the Farallones National Marine Sanctuary (GFNMS)

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1. Introduction

In April 2000, the National Centers for Coastal Ocean Science (NCCOS) and the Office of National Marine Sanctuaries (ONMS) began a partnership with the purpose of augmenting the management of the National Marine Sanctuaries (NMS) through increased scientific understanding of the sanctuary sites. The first few years of the partnership saw NCCOS scientists working with a handful of sanctuaries. As the partnership matured, collaborative efforts between NCCOS and ONMS increased, and in FY2004 and FY2005, research projects are tentatively funded in 9 of the 14 sites. In addition to research, NCCOS has appointed liaisons to each of the sites. Liaison duties include: being knowledgeable of science activities and capabilities of NCCOS, being knowledgeable of the site's management needs, being knowledgeable of ongoing research and science needs in the site, identifying and assessing research gaps and areas of potential collaboration between NCCOS and ONMS, and working with the site to refine and address their science needs to meet their management objectives.

2. Sanctuary Overview

The National Marine Sanctuary Program was created by Congress through Title III of the Marine Protection, Research and Sanctuaries Act of 1972. The Act allowed marine areas identified for their biodiversity, ecological integrity, and cultural legacy to receive protection similar to national parks.

Gulf of the Farallones Marine Sanctuary (GFNMS) was established in 1981 to improve the protection of the marine environment and resources within the sanctuary. The sanctuary is currently managed through offices on the Presido in San Francisco, California. The adjoining Cordell Bank National Marine Sanctuary (CBNMS) was formed in 1989 and managed through the GFNMS office until 1998. Although distinct, CBNMS continues to work closely with GFNMS to fulfill both sanctuaries' missions.

GFNMS protects an area of 3252 km^2 off the northern California coast. The shoreward boundary extends along the coast from Rocky Point to Bodega Head. The sanctuary abuts the Point Reyes National Seashore along much of the shoreward boundary. In the northern portion, the offshore boundary abuts the inshore edge of CBNMS. In the southern portion, the offshore edge follows a 12 mile arc around the Farallone Islands. The southern boundary abuts the

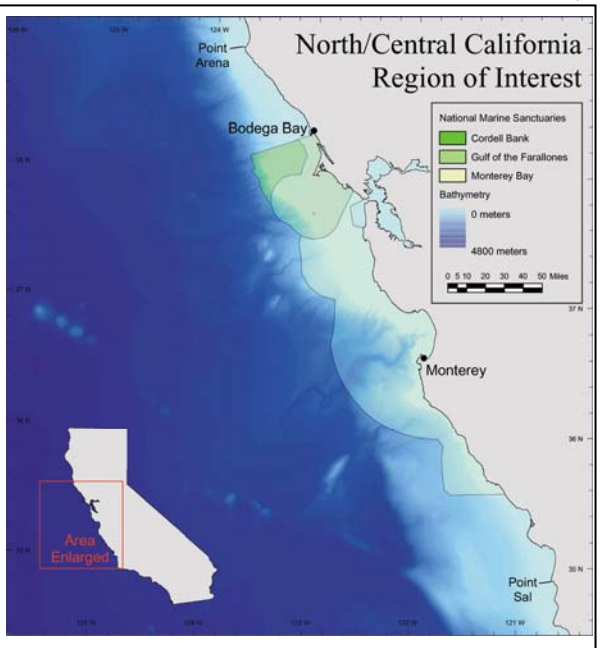

Figure 1. Map of north central California coast showing the boundaries of Cordell Bank National Marine Sanctuary, Gulf of the Farrallones National Marine Sanctuary, and Monterey Bay National Marine Sanctuary.

northern boundary of the Monterey Bay National Marine Sanctuary (MBNMS). A wide range of habitats are included in GFNMS. Rocky shorelines and estuarine areas occur along the shoreline. Estuarine areas include Bolinas Lagoon, Estero San Antonio, Estero de Americano, Tomales Bay, and Bodega Bay. Shelf areas include unconsolidated sediments of mud, fine sand, sand, and shell hash. Rocky outcrops are also found on the shelf and include submerged areas and emergent areas (Farallone Islands) on the outer shelf. The range of habitats within the sanctuary result in a rich and diverse community of plants and animals.

The area of the GFNMS was selected for protection largely based on the abundance of seabirds and aquatic birds, marine mammals, fish, marine plants, and benthic fauna. The 1987 management plan identified nesting seabird populations as the most significant resource of the sanctuary. Twelve of the sixteen species of marine birds known to breed along the U.S. Pacific coast have colonies on the Farallone Islands. In addition to seabirds, 123 species of aquatic birds have been recorded in the wetland areas of the sanctuary. Five species of seals and sea lions and seventeen species of whales, dolphins and porpoises are regularly observed in the sanctuary. Owing to the large variety of marine and estuarine habitats in GFNMS, there are also a wide diversity of fish and invertebrates species including Pacific salmon and Dungeness crab. Commercially important species are better known than non-commercial species, and the fish and invertebrate faunas from intertidal and nearshore areas are better documented than those from offshore areas.

Currently regulations prohibit: oil and gas exploration and development; vessel discharges, effluents from marine sanitation devices, fish wastes and bait; seabed alteration or construction, with the exception of anchoring, repair of breakwaters and jetties in Tomales Bay, installing navigation aids, and traditional fishing operations; oil tankers, barges, and other merchant vessels within two nautical miles of the Farallone Islands, Bolinas Lagoon, and Areas of Special Biological Significance; aircraft within one nautical mile of biologically sensitive areas must maintain an altitude of at least 1000 feet; damaging or removing historical or cultural resources; and Motorized Personal Watercraft (MPWC)[1, 2]. California Fish and Game enforces federal as well as state fishing regulations in CBNMS. The U.S. Coast Guard has broad responsibility for enforcing all Federal laws in navigable waters under U.S. jurisdiction.

3. Management Goals and Concerns

GFNMS is managed under the original 1987 management plan[3]. This plan is currently under revision, but the revision is being conducted jointly with the revision of the management plans for MBNMS and CBNMS. These sanctuaries are located adjacent to

[1] The complete regulations for GFNMS can be found at http://www.sanctuaries.nos.noaa.gov/jointplan/current/regs/GFNMS_Regs.pdf (link last checked 11 January, 2005).
[2] Regulation related to the use of MPWC can be found at http://www.gfnms.nos.noaa.gov/manage/mwpc.pdf (link last checked 11 January 2005).
[3] Available at http://www.sanctuaries.nos.noaa.gov/jointplan/current/mp/FarallonesMP.PDF (link last checked 11 January, 2005).

one another, and share many of the same resources and management issues. All three sanctuaries also have overlapping interests and users groups. Action Plans have been developed for each sanctuary and are currently under review. In October 2004, the Pacific Fishery Management Council was asked to prepare draft sanctuary fishing regulations for MBNMS and CBNMS. Accompanying the request was a document that provided background information, action alternatives, and preferred actions. For the purposes of identifying management goals and concerns, the 1987 Management Plan and the recent Joint Management Plan Review Recommendations for GFNMS[4] are used here as sources.

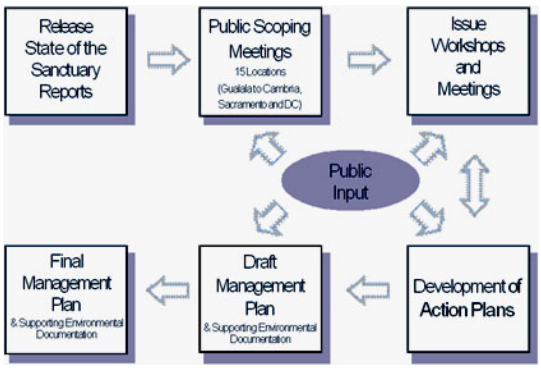

Figure 2. Process for joint management plan revision for Cordell Bank, Gulf of the Farallones, and Monterey Bay National Marine Sanctuaries. Figure from http://sanctuaries.nos.noaa.gov/jointplan/schedule.html (link last checked 16 November 2003).

The 1987 Management Plan identified long-term protection of significant marine resources of the Gulf of the Farallones as the highest priority for management. Research and education objectives are designed to support the resource protection objectives. Each resource protection issue is listed below with a brief discussion of the strategies.

1) Develop ability to respond to accidental spills. Given the amount of tanker traffic passing through the sanctuary, there is a high probability of a spill occurring. The immediate and long-term effects of spills of various types are not well understood and the capability for effectively controlling the effects of a major spill is limited.

2) Develop ability to respond to and limit chronic pollution of sanctuary waters. There are a number of offshore and land-based sources of pollution that could be affecting GFNMS resources. The location and volumes of chronic discharges are not well documented and the long-term effects on sanctuary resources are not known.

3) Collect information relating to marine mammal and seabird interactions with fisheries and pass this information on to relevant management agencies (California Fish and Game, National Marine Fisheries Service). At the time the management plan was written, entanglement of marine mammals and sea birds in gill nets and trammel nets was a major source of mortality. In 2000, California banned the use of gill nets and trammel nets in some state waters less than 60 fathoms and the area covered by

[4] available at http://www.sanctuaries.nos.noaa.gov/jointplan/reptoad/gf_pdf/gf_reptoad_p1.pdf and http://www.sanctuaries.nos.noaa.gov/jointplan/reptoad/gf_pdf/gf_reptoad_p2.pdf (link last checked 11 January, 2005)

the ban has been increased several times[5]. Other fishing activities also affect marine mammal and sea-bird populations.

4) Collect information relating to visitor use impacts on marine mammals, intertidal invertebrates, and other sensitive resources. Visitor use impacts include shellfishing and visitor disturbance of harbor seal breeding beaches. Future increases in visitor use could lead to even more pronounced impacts on sanctuary resources.

5) Maintain the quality of sensitive and/or critical habitats within the sanctuary. GFNMS contains some of the most pristine estuarine and saltmarsh habitat on the Californian coast. In addition, the sanctuary contains unique intertidal pools, subtidal reefs, and eel grass beds. The role of these areas as Essential Fish Habitat needs to be investigated. Further, the anthropogenic impacts on these habitats need to be understood.

The Joint Management Plan Review Recommendations for GFNMS included five site-specific issues, which overlap substantially with the resource protection issues identified in the original management plan.

1) Water quality – The water quality in the sanctuary is generally good, however, the coastal waters of the sanctuary, particularly the estuarine areas, are vulnerable to land-based non-point source pollution. In addition, discharge from the San Francisco Bay estuary, which drains large agricultural areas and discharge from 8 million people living in the Bay Area, could potentially impact the sanctuary. In response, a water quality goal was proposed, 'to engage in corrective and proactive measures to protected and enhance water quality in the estuarine, nearshore, and offshore environments of the sanctuary'. To achieve this goal, two objectives and 14 strategies were proposed.

2) Wildlife Disturbance – Wildlife disturbance occur both naturally and as a result of human interactions. The pressures on wildlife in GFNMS continue to grow with increases in human population. Of specific concern to GFNMS are negative impacts associated with: trampling and collecting in the intertidal; interactions with white sharks, disturbances form hikers, boaters, and low flying aircraft; ocean noise; fisheries interactions; and entanglements. The proposed goal was to 'to lessen or eliminate, and remedy impacts on the living marine resources of the sanctuary and their habitats by encouraging responsible human behavior. To achieve this goal, two objectives and 11 strategies were defined.

3) Introduced Species – Introduced species have been identified in and around GFNMS and have the potential to cause ecological and economic degradation to the affected coastal areas. In response, two goals were proposed: 1) to prevent future introductions of exotic species in the sanctuary, and 2) to detect, manage, and where

[5] Press release relating to ban is available at http://www.dfg.ca.gov/news/news02/02044.html (link last checked 11 January, 2005).

feasible, eradicate new and established introduced species in the sanctuary. To achieve these goals, four objectives and nine strategies were proposed.

4) Ecosystem Protection: Impacts for Fishing Activities – Fishing impacts in and around the sanctuary are not well understood, yet fishing poses a major threat to resources in the sanctuary. Two goals were proposed: 1) to better understand the impacts from fishing activities on sanctuary resources, and 2) to allow for fishing that is compatible with sanctuary goals and ecosystem protection. To achieve these goals, three objectives and 12 strategies were defined.

5) Vessel Spills – There is a risk of vessel spills in the sanctuary and a spill could negatively impact marine mammals, seabirds, and other natural resources in and around the sanctuary. In recognition of this threat, the goal was proposed 'to minimize the risk to GFNMS natural resources from spills, while allowing for continuation of safe, efficient, and environmentally sound transportation'. To achieve this goal, five objectives and sixteen strategies were proposed.

In addition to developing goals and strategies on five issues of concern for resource protection, goals, objectives and strategies were defined for education issues, administrative issues, processes identifying new and emerging issues, and boundary modifications issues. Several modifications also were suggested for current regulations: 1) changes to the language prohibiting oil, gas, and mineral exploration and development, 2) changes to the language prohibiting discharges, 3) changes to the language regarding the alterations and construction, 4) changes in the language regarding removing or damaging historical or cultural resources, 5) a change the boundary description to "area of marine waters." Several new regulations also were proposed: 6) depositing or discharging materials outside the sanctuary that move into the sanctuary, 7) prohibiting lightering in the sanctuary; 8) prohibiting introduction of exotic or genetically modified species; 9) prohibiting feeding or attracting a living resource, except for lawful fishing; and 10) adoption of a cruise ship discharge prohibition consistent with MBNMS's new proposal, and 11) overlay regulation for Migratory Bird Treaty Act, Marine Mammal Protection Act and Endangered Species Act.

4. Current Sanctuary Research Projects and Summary of Ongoing and Planned NCCOS/ONMS Partnership Activities

BeachWatch – GFNMS trains citizen-scientists to survey and document the resources of the Sanctuaries. The goals of Beach Watch are to help protect and understand our coastal resources by: 1) creating a long-term data set of the bird and mammal resources for each beach from Bodega Head to Point Ano Nuevo, 2) assisting the sanctuary in early detection of natural or human-caused disturbances, such as oil spills, and 3) developing a network of local stewards that document and exchange information on the biological and physical changes a particular beach may undergo throughout the various seasons over several years.

SEALS – Sanctuary Education Awareness and Long-Term Stewardship uses volunteers to help protect pupping harbor seals in the sanctuary. The program has been in place since 1996 and the number of harbor seals pups are monitored. Volunteers also participate in harbor seal population counts contributing to a larger-scale effort from northern to central California.

Habitat Investigations– Some habitat investigations have been conducted in GFNMS in combination with efforts in CBNMS and MBNMS. During 2004 a cruise was completed that examined benthic habitats in all three sanctuaries[6] and one track-line was made through GFNMS.

Ecosystem Dynamics Study – GFNMS is involved in exploration and investigation of marine life and through a joint project with CBNMS. This long-term study focuses on the dynamics of krill, an important species in the food web of CBNMS and GFNMS. Both acoustic and net sampling are used and the parameters affecting krill distribution are measured. These data are also analyzed in combination with seabird and marine mammal observation data. Some of these data have been described in a publication *Beyond the Golden Gate-Oceanography, Geology, Biology, and Environmental Issues in the Gulf of the Farallones*[7].

Remote Sensing Applications – As part of the FY2004 and FY2005 NCCOS/ONMS Partnership, CCMA was funded to apply several remotely sensed data sets to describe the oceanography in the area of GFNMS (as well as CBNMS and MBNMS). This project directly contributes to one of the CBNMS priority research needs: complete and detailed understanding of the oceanographic and atmospheric conditions in and around the sanctuary (see below). Processing of monthly, 5 day, and 8 day Pathfinder SST data has been completed for data from 1985-2001. Time series data has been extracted from the available SST data for all three sanctuaries. Chlorophyll and turbidity imagery (SeaWiFS) are continuously being processed as they are received.

Biogeographic Assessment – CCMA conducted a biogeographic assessment of the northern California coast including GFNMS[8]. The assessment identifies and collects relevant biological datasets for the sanctuary and combines these datasets in a GIS framework. This assessment is being used in the revision of the Joint Management Plan for MBNMS, GFNMS, and CBNMS.

5. Research Gaps and Future Needs

ONMS conducted comprehensive assessment of the science activities in the program (Gittings et al., 2002)[9]. The information in the assessment was largely identified in a 2001 workshop, which evaluated how well the sanctuary management issues were being

[6] http://www.mbnms-simon.org/other/moreLinks/whats_new_mac.php (link last checked on 11 January, 2005)
[7] http://geopubs.wr.usgs.gov/circular/c1198/C-1198.pdf (link last checked on 11 January, 2005)
[8] http://biogeo.nos.noaa.gov/products/canms_cd/ (link last checked on 11 January, 2005)
[9] Gittings, S., K. Benson, P. Souik, and M. Tartt. 2002. Sanctuary Science: Evaluation of Status and Information Need. Available at: http://sanctuaries.nos.noaa.gov/library/national/science_eval.pdf

addressed by science activity and provided direction for future science resources. The assessment was both across the program and site specific and serves here as a starting point for identifying research gaps and future needs for GFNMS.

Priority information needs identified by Gittings et al. (2002) for GFNMS include fishing/harvest effects, zoning issues, and factors effecting success of year class strength. Gittings et al. (2002) concluded that GFNMS was doing a good job meeting their water quality and event response needs.

The 1987 Management Plan identified three research needs. 1) Develop baseline information about the distribution, abundance, and status of marine resources, particularly within the Gulf of the Farallones. 2) Develop information on the dependence of populations on the Gulf of the Farallones food resources and critical habitats. 3) Develop information on the effects of natural events and human-related activities on populations within the sanctuary.

As discussed above, the Joint Management Plan Review Recommendations for GFNMS included five site-specific issues, which overlapped with the issues identified in the 1987 Management Plan. The Joint Management Plan Review Recommendations were issue based and did not separate out research needs from other needs. Below is a list of strategies from the Joint Management Plan Review Recommendations for GFNMS that were deemed to be research needs.

> WQ-7 – Develop ancillary monitoring program through the Ecosystem Dynamics Study for “in-depth” tracking of phytoplankton populations to detect harmful algal blooms.
>
> WD-1 – Through the use of volunteer monitoring programs, observe and record impacts from human activity on marine resources such as marine mammals and seabirds, and key habitats such as sandy beaches and rocky intertidal.
>
> WD-3 – Develop research and/or monitoring programs to better understand and address noise, light and visual impacts on marine mammals and seabirds from low flying aircraft.
>
> WD-4 – Develop research and/or monitoring programs to better understand and address impacts on wildlife from vessel disturbances.
>
> IS-2 – Develop a program, in coordination with existing monitoring programs, to detect introduced species in estuarine environments of the sanctuary.
>
> IS-3 – Develop monitoring program to detect and monitor introduced species in the rocky intertidal areas of the sanctuary.
>
> IS-4 – Develop monitoring program to detect and monitor introduced species in the pelagic environment of the sanctuary

FA-1 – Develop a resource characterization of the sanctuary to better understand types and distributions of habitats, species, ad processes.

FA-3 – Evaluate impacts from fishing activities on sanctuary resources.

VS-2 – Improve existing spill and drift model to increase accuracy of risk assessments.

VS-6 – Track distribution and numbers of sensitive species and habitats in relation to probable spill trajectories.

The needs identified in the Joint Management Plan Review Recommendations include the needs identified in the Gittings et al. (2001) report and the 1987 Management Plan, but other needs are also identified. In addition to fishing/harvest effects, zoning issues, and factors affecting year-class success, the Joint Management Plan Review Recommendations identified needs associated with water quality, wildlife disturbances, introduced species, and spill impacts.

The research needs of GFNMS are extensive. In part, these needs result from the large expanse of the sanctuary and the inclusion of estuarine, coastal, and ocean environments. Some of the elements to meet the research needs of the sanctuary are in place such as cooperation with CBNMS with the Ecosystem Dynamics Study, as well as the volunteer programs to monitor harbor seal populations and monitor coastal areas. In addition, the NCCOS remote sensing study is providing the basis for "in-depth" tracking of phytoplankton populations to detect harmful algal blooms. The NCCOS biogeographic assessment contributed to the development a resource characterization of the sanctuary.

Some of the research needs of GFNMS could possibly be integrated with monitoring activities conducted by the National Marine Fisheries Service Southwest Fisheries Science Center (SWFSC). Plankton surveys occur off of southern California as part of the CalCOFI (California Cooperative Oceanic Fisheries Investigations) program. Juvenile rockfish surveys are conducted by scientists at the SWFSC Santa Cruz Laboratory. Marine mammal surveys also are conducted by the SWFSC. Integration of efforts and combination of resources, in addition to that identified in the Joint Management Plan Review Recommendations, could benefit both the missions of SWFSC and ONMS.

6. Overview of NCCOS Science Capabilities

NCCOS was formed in March 1999 to concentrate coastal research capabilities within a National Ocean Service (NOS) office. Elements forming NCCOS were drawn from NOS and the National Marine Fisheries Service (NMFS). NCCOS is composed of a headquarters in Silver Spring, Maryland, and five research centers: the Center for Sponsored Coastal Ocean Research in Silver Spring, Maryland; the Center for Coastal Monitoring and Assessment in Silver Spring, Maryland; the Center for Coastal Fisheries

and Habitat Research in Beaufort, North Carolina; the Center for Coastal Environmental Health and Biomolecular Research in Charleston, South Carolina; and the Hollings Marine Laboratory in Charleston, South Carolina.

The focus of NCCOS is to provide useful and valuable scientific information and services through the conduct and support of research to further the NOAA environmental and economic missions. The scientists within NCCOS conduct applied research and manage complex long-term research projects. The projects provide a link between research science in academia and the needs of those who make decisions on use of coastal and marine areas. Driven by NOAA's mandates in content and in timing, the science conducted and supported by NCCOS focuses on applicability to agency and constituents' needs for practical answers.

Each Center has specific capabilities and research expertise in important ocean and coastal issues and contributes in its own way to the overall NCCOS mission.

Center for Sponsored Coastal Ocean Research – CSCOR provides funding to academic and federal researchers investigating a wide range of science issues directly related to NOAA's management needs. Funded programs include GLOBEC (Global Ocean Ecosystem Dynamics) and ECOHAB (Ecology and Oceanography of Harmful Algal Blooms). More information about CSCOR can be found on the Center's factsheet (http://coastalscience.noaa.gov/documents/factsheet_cscor.pdf) and on their website (http://www.cop.noaa.gov).

Center for Coastal Monitoring and Assessment – CCMA conducts monitoring and assessment of coastal environmental quality, coastal habitats, and coastal resource distribution. Major programs exist in biogeographic characterization, bioeffects monitoring, and remote sensing. CCMA also has extensive GIS expertise. More information about CCMA can be found on the Center's factsheet (http://coastalscience.noaa.gov/documents/factsheet_ccma.pdf) and on their website (http://ccmaserver.nos.noaa.gov).

Center for Coastal Fisheries and Habitat Research – CCFHR conducts research on habitat ecology, fisheries oceanography, and plankton ecology and physiology. Research blends field-base studies, laboratory studies, and modeling activities. The Center has also the capability to culture marine and estuarine species. In addition, NMFS researchers are part of CCFHR and research themes include marine mammal and sea turtle research, reef fish ecology, and population dynamics. More information about CCFHR can be found on the Center's factsheet (http://coastalscience.noaa.gov/documents/factsheet_ccfhr.pdf) and on their website (http://shrimp.ccfhrb.noaa.gov).

Center for Coastal Environmental Health and Biomolecular Research – CCEHBR used a combination of chemical, biomolecular, toxicological and ecological techniques to examine health of coastal ecosystems, environmental quality, and public health impacts. Major research areas include marine ecotoxicology, marine pathology, coral health, invasive species management, protected species health, marine forensics, and

environmental risk analysis. More information about CCEHBR can be found on the Center's factsheet (http://coastalscience.noaa.gov/documents/factsheet_ccehbr.pdf) and on their website (http://www.chbr.noaa.gov).

Hollings Marine Laboratory – HML opened in 2002 and provides science and biotechnology applications to examine the linkages between the environment and human health. HML is co-occupied by several partnering institutions including NCCOS, South Carolina Department of Natural Resources, University of Charleston, National Institute of Standards and Technology, and the Medical University of South Carolina. More information about HML can be found on the Center's factsheet (http://coastalscience.noaa.gov/documents/factsheet_hml.pdf) and on their website (http://www.nccos.noaa.gov/about/hml.html).

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